Initial Discoveries of Fish Faunas on Seamounts and Offshore Banks in the Eastern Pacific[1]

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The recent discovery in the Pacific Ocean of numerous submerged mountains (Hess, 1946; Menard and Dietz, 1951; Menard, 1955, and in press), including "banks" (rising to a depth of less than 100 fathoms) as well as the flat-topped "guyots" and other "seamounts" (with minimum depths greater than 100 fathoms), has posed intriguing questions regarding their faunas. Some of these questions are:

What species inhabit the individual banks and seamounts, and in what regularity and abundance?

How did these species become dispersed to and established on these structures?

What bearing may the determined constitution of these isolated faunas have on our ideas concerning past and present oceanic circulation and temperatures?

Do the banks and seamounts (as well as the islands) provide stepping stones for the transgression of narrow to broad oceanic areas, even the supposedly vast eastern Pacific barrier that separates the Indo-Pacific and American faunas (Ekman, 1953: 21, 72, 292)?

May some elements in the faunas of the deeper seamounts be relicts that have become adapted to increasing depths as the seamounts have subsided (or become flooded)? If so, the faunistic evidence may have some bearing on the historical interpretation of the seamounts.

To what degree has isolation on the banks and seamounts led to speciation?

Are either demersal or pelagic fishes (or other animals) sufficiently abundant and available on or over these isolated rises to yield profitable fisheries?

What factors, physico-chemical or biotic, are responsible for the abundance of life on and over these rises? The first thought that comes to mind is that the elevations in the bottom contour induce disturbances in the deep currents, which no doubt have greater velocities than they were long thought to have, and that such disturbances induce upwelling and the enrichment of the upper waters.

Systematic explorations of the faunas on the isolated banks and seamounts (and oceanic islands) should yield rich returns, both scientifically and commercially. As yet only fragmentary information has been accumulated. Some such fragments of data, recently acquired, concerning the fish faunas on seamounts and banks from the Gulf of Alaska to far-off Chile, are presented here.

Embassichthys bathybius (Gilbert) on Pratt Seamount

On August 22, 1951, an adult "deepsea sole" 242 mm. in standard length surprisingly was caught in a rock dredge being hauled at a depth of 510 fathoms on the side slope of Pratt Seamount in the Gulf of Alaska, at Lat. 56° 20′ N., Long. 142° 30′ W., about 210 nautical miles offshore. It was obtained by Henry W. Menard and John D. Isaacs on the research ship "Horizon," on the Northern Holiday Expedition of the Scripps Institution of Oceanography (Dredge No. 5; Collection SIO 53-187).

This record constitutes a notable northward as well as seaward extension of the range of this deep-water pleuronectid. Long known

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only from off southern California, recently it has been reported from off northern California (Hagerman, 1950) and from off Washington (Welander and Alverson, 1954: 42–43).

Unpublished records show that this commercially utilizable fish is not uncommon in deep waters off northern California and Washington. It is becoming of minor importance in the trawl fishery, as operations are being extended into deeper water. Its occurrence on at least one seamount suggests the possibility that the trawling grounds may eventually be extended far seaward, where depths are appropriate.

I have underway a distributional and variational study of this poorly-known flounder.

Sebastodes ruberrimus Cramer and Other Fishes on Cobb Seamount

A rockfish caught on Cobb Seamount, about 280 nautical miles off Washington and about 240 miles southwest of Vancouver Island, at Lat. 46° 44′ N., Long. 130° 47′ W., was described by Welander and Alverson (1954: 37–40, figs. 1, 2) as representing a new species, *Sebastodes bilineatus*. By examining this specimen (No. 10099, University of Washington Fish Collection) in detail on June 11, 1956, I verified the belief of Julius B. Phillips, W. I. Follett, and myself that it is a specimen of the large *S. ruberrimus*, in the striped, juvenile stage. The contrast between the dark ground color and the light stripes is unusually bold, but since color intensity varies so greatly in fishes and since all other characters observed fall within the observed range of variation of *S. ruberrimus*, it seems doubtful that the species is modified on Cobb Seamount. Slight differentiation, however, is a remote possibility. Data on the type of *S. bilineatus* will be included in a forthcoming contribution by Hubbs and Follett.

Thompson (1915: 121) observed that *S. ruberrimus* is "the most abundant of all species of the genus on the halibut banks," but in the same paper described what is now thought to be a specimen of this species as *S. babcocki*, new species.

Welander and Alverson mentioned that the type of *S. bilineatus* was one of 30 fish specimens "caught by personnel of the U. W. oceanography vessel Brown Bear in the vicinity of Cobb Seamount on August 7, 1953." It is to be hoped that complete lists of species taken on or about each seamount will be published.

Perhaps fisheries may develop on the seamounts for rockfishes (*Sebastodes* spp.), as well as for the halibut, *Hippoglossus stenolepis* Schmidt, and other flatfishes.

Shore and Pelagic Fishes on Banks and Seamounts off Central California

A number of coastal and pelagic fishes of expectable species were recorded by Follett (1952) from several banks and seamounts off the central California coast, at no very great distance offshore. This is not to mean, however, that high interest and potential importance is not to be attached to such inshore rises.

Tunas and Tuna Forage Fishes from "Stranger Bank" ("Hurricane Bank")

In 1957, on an expedition from Scripps Institution of Oceanography, on the research ship "Stranger," Adrian F. Richards discovered, at Lat. 16° 52′ N., Long. 117° 30′ W., roughly 200 nautical miles southwest of Clarion Island, a shallow bank rising from oceanic depths to a depth of approximately 15 fathoms. This bank was assigned the tentative name Stranger Bank by the discoverer. Tuna fishermen of San Diego, who dub the structure "Hurricane Bank," from the heavy weather often encountered there, promptly began fishing there and in less than a year had taken from the newly found fishing ground well over 1,000 tons of yellowfin tuna, *Neothunnus macropterus* (Temminck and Schlegel), and smaller quantities of skipjack tuna, *Katsuwonus pelamis* (Linnaeus). At the time of writ-

ing it is evident that within the first full year the catch will definitely exceed 2,000 tons, with a value to the fishermen of more than one-half million dollars; and the relative proximity of the ground represents a great saving in expenses. Tuna fishermen have reported taking some rainbow runners, *Elegatis bipinnulatus* (Quoy and Gaimard), from this same bank.

During the Island Current Survey of May–June, 1958, personnel of the Inter-American Tropical Tuna Commission caught about the bank a number of young yellowfin tuna. On June 1 an adult male of the labrid *Bodianus diplotaenius* (Gill) was caught on the shoalest part of the bank (it was identified from a kodachrome). Many sharks, including some hammerheads, *Sphyrna* sp., were seen, to confirm the reports that sharks abound here. On June 5 one wahoo, *Acanthocybium solandri* Cuvier, was caught, and several mantas, presumably *Manta hamiltoni* (Newman), were seen.

Further information on other fishes that live over and about this bank comes from an initial examination of stomach contents of yellowfin tuna, collected there for the Inter-American Tropical Tuna Commission and now being analyzed by the staff of the Commission. Young to half-grown specimens of the spiny trunkfish, *Lactoria diaphana* (Bloch and Schneider), constitute a notably high proportion of the food. Some stomachs are filled with this bony creature, which elsewhere has been found to be eaten by this tuna. This trunkfish ranges very widely through tropical regions, and even, on occasions, as far northward as California. A sample (SIO 58–56) from the stomach of a tuna caught on this bank comprises 487 specimens of this trunkfish, 13 to 44 mm. in standard length. Another lot (SIO 58-57) comprises 7 specimens, of similar size. One tuna contained a large young triggerfish (SIO 58-54) of the common, wide-ranging, more or less pelagic species *Xanthichthys lineopunctatus* (Hollard); its standard length is 52 mm. Remains of flying fish of undetermined species also occur in the tuna stomachs.

A thorough study of the fish fauna of Stranger Bank is much to be desired, especially in view of the thorough analysis of the Revillagigedo fish fauna being conducted by Boyd W. Walker and associates.

For information and material on the fishes and fisheries of this bank I am indebted to Bell M. Shimada and Franklin G. Alverson of the Inter-American Tropical Tuna Commission and to Wilbert M. Chapman of the American Tunaboat Association.

Pterygotrigla picta (Günther) on a Guyot far off Chile

On January 26, 1958, a triglid fish (gurnard or sea robin) of considerable zoogeographical interest was captured incidentally in a rock dredge being hauled at a depth of 129 fathoms on a guyot rising from an extensive ridge in the southeastern Pacific. It was preserved by Robert H. Parker on the research ship "Spencer F. Baird" of Scripps Institution of Oceanography, on the I. G. Y. Downwind Expedition (Station 73; SIO 58-42). This unnamed guyot is at Lat. 25° 44′ S., Long. 85° 25′ W., which is about 800 miles off the Chilean coast, about 300 miles westerly from Isla San Felix, and nearly 600 miles northwest of Isla Juan Fernández. It is in a region where seamounts appear to be numerous, and is on a submarine ridge that seems to extend westward at least to Easter Island (Fisher, 1958: 20–25, figs. 1, 8, 9).

Although the specimen is young (54 mm. in standard length) and was badly crushed posteriorly in the rock dredge, it seems identifiable as *Pterygotrigla picta* (Günther). This species was originally very briefly described, but magnificently figured, by Günther (1880: 24–25, pl. 13, fig. A), as *Trigla picta*, on the basis of a 10.5-inch specimen collected by the "Challenger" on Isla Juan Fernández, far off the coast of Chile. The species has been reported also from New Zealand and Australia (McCulloch, 1929: 393), but not from the

American mainland. This distributional pattern seems to be related to the bottom topography within the south temperate zone of the Pacific: there is a very deep trench off the Chilean coast, but from the vicinity of islas Juan Fernández and San Felix westward numerous submarine ridges and peaks rise to various heights below and above sea level. It may be predicted that the species will be found not only on the guyot nearly 600 miles northwest of Juan Fernández, but also on other rises between the offshore islands of Chile and New Zealand. It is not known whether seamounts intervene between Juan Fernández and San Felix, and it is now doubted that the long charted intervening ridge exists.

This young specimen differs in a number of respects from the characters indicated in the original description and figure of *Trigla picta*, but these differences seem attributable to age and individual variation. The dorsal spines number VIII instead of VII, but the eighth is short and very slender (and is perhaps concealed in the type); the number of dorsal soft rays (12) agrees. The anal rays are 11, not 12, but some variation is expected. (The principal caudal rays number 6 + 5 = 11, and each pectoral has 15 rays, in the formula i, 9, ii + 3.) The nuchal spine is much longer, reaching to below the base of the third dorsal spine (probably as a function of youth), and is about as long as the humeral spine. (The pectoral fin, as in the type, reaches to about the seventh anal ray.) The preopercular spine (at the end of the cheek ridges) is double, rather than single, but the lower point is definitely the smaller, and it probably becomes obsolete in larger fish. The body is similarly marked with light-ringed blackish spots, but these spots (as expected) are fewer. On the head the spots are discernible, though faint, as though just developing. The fins, unlike those on the type, are unspotted: in the spinous dorsal the membranes are sooty outward; the second dorsal has a submarginal dark band; the pectoral is very dark, except for a light border; the other fins are almost wholly clear. In coloration the young specimen corresponds better with the figure given by Mann (1954: 309) for the "pez mariposa de Juan Fernández," which he designated *Chelidonichthys pictus*.

Trigla picta has been referred, properly I think, to the genus *Pterygotrigla* Waite (1899: 108), which was based on the Australian species *Trigla polyommata* Richardson. Although quite different in coloration, *P. picta* and *P. polyommata* seem very similar in structure.

The genus *Pterygotrigla* has been attributed to Japan (Matsubara and Hiyama, 1932: 8–14, figs. 2–5), but the Japanese species referred to the genus differ trenchantly from *P. picta* and *P. polyommata* in lacking vomerine teeth. They are also said to have a "distinct anal spine" (a hardened soft-ray?), which does not seem to be true of the Southern Hemisphere species. Though the two groups agree in many characters it seems advisable to put them in separate genera. The name *Otohime* Jordan and Starks (1907) is available for the common Japanese species *hemisticta* (the type species), and probably for *Pterygotrigla ryukyuensis* Matsubara and Hiyama.

Otohime differs further from *Pterygotrigla* in the small size of the dorsal bucklers. The distinction in the first anal ray may not be valid, for a young specimen of *Otohime hemisticta* has this ray paired, articulated, and flexible.

It seems clear from the original account that *Trigla guttata*, which was described without comparisons by Philippi (1896: 375–376) from Juan Fernández, is a synonym of *Pterygotrigla picta* (Günther)—as was assumed by McCulloch (1929: 393). But the gurnard from Islas Juan Fernández that was figured and discussed by Mann (1954: 309) as *Trigla punctata* Philippi obviously belongs in a very different species. From the figure it seems clearly referable to *Chelidonichthys*, as defined by Matsubara and Hiyama (1932: 4). It even seems probable that the specimen may be referred to *C. kumu* (Lesson and Garnot), an

important species that is accorded a range from New Zealand and Australia to Japan (see Matsubara and Hiyama, 1932: 5–7, fig. 1). Like *Pterygotrigla*, *Chelidonichthys* is unknown in Chile. Its occurrence on Juan Fernández parallels that of *Pterygotrigla picta*, and it may be predicted that *Chelidonichthys* will be found on seamounts, banks, or islands between Juan Fernández and New Zealand.

Both *Pterygotrigla* and *Chelidonichthys* belong to a distributional category that may be classified as antitropical Indo-Pacific, and contrast sharply with the American triglids (*Prionotus* and the derived *Bellator*). Comparison of a specimen of *P. picta* from Isla Juan Fernández (an adult 340 mm. in standard length collected by the Mellon Expedition in Bahia Cumberland on February 28, 1936) with specimens of *Chelidonichthys kumu* from Japan discloses many differences. The row of keeled scales along the entire dorsal base is replaced by greatly enlarged flat bucklers along the base of the spinous dorsal only. *P. picta* differs further from *C. kumu* in a feature of the lateral line, which ends simply, immediately beyond the caudal base, instead of being forked and continued as two or three lines across the caudal fin. The head is much larger, and the body is much more contracted at the base of the caudal fin, which is sharply forked rather than merely emarginate. The orbital rim is spineless, but the opercular, nuchal, and humeral spines are greatly enlarged. The nape, in advance of the greatly enlarged buckler surrounding the first dorsal spine, is scaleless rather than scaly. The teeth are almost shagreenlike; those of the lower jaw are deflected outward over the anterior edge of the lower lip. The vomerine teeth are in an oval rather than a broadly V-shaped patch. Most of these differences show in the figures reproduced by McCulloch (1922: 119, pl. 39).

NEED FOR FURTHER STUDIES

These brief notes tend to show that great scientific as well as commercial importance may be attached to a study of the faunas of the many banks and seamounts that rise toward the surface from the depths of the Pacific Ocean. Many and perhaps most of these structures seem capped and surrounded by productive water. The spectacular take of tuna on the Stranger, or Hurricane, Bank has been mentioned. Milner B. Schaefer, director of research for the Inter-American Tropical Tuna Commission, has assured me that good catches have been made about other banks and even about seamounts that nowhere closely approach the surface. Henry W. Menard of the Institute of Marine Resources, University of California, leading student of seamounts, tells me that he has obtained strong field indications, from echograms, that large objects (presumably fish or giant squid) form a halo around and far above many seamounts between California and Hawaii. It seems highly probable, as is stated in the introduction, that the submarine mountains, even those that are isolated and deep, disturb the currents sufficiently to induce extensive upwelling.

The benthic faunas of the banks and seamounts do not give promise of such commercial potential, but may prove of greater scientific interest, particularly in respect to zoogeography and speciation.

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